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Mini Review

Evaluate How Brine Exposure Affects the Pathogen Defences and Regulatory Elements

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Abstract

Soil salinity is an increasingly serious problem worldwide, severely limiting plant growth and yield, and posing a major challenge to plant breeding. The basic leucine zipper (bZIP) transcription factor is the most conserved transcription factor and a key regulator controlling various plant response processes to external stimuli.

Highly conserved DNA-binding alkaline regions and diverse leucine zippers, one of the largest families of plant transcription factors. Plant bZIP is involved in many biological processes, such as flower development, seed maturation, dormancy, and senescence, and is involved in salinity, drought, cold, osmotic stress, mechanical injury, and ABA signaling responses. Involved. It plays an important role in human abiotic stress. In this review article, we summarize and describe the structural and functional characteristics of the bZIP transcription factor group, the bZIP transcription factor complex and its molecular regulatory mechanisms related to the regulation of transcription factors in salt stress tolerance and plant salt stress tolerance. This review provides a theoretical basis and research ideas for further investigating the functions of bZIP transcription factors related to salt stress. It also provides a theoretical basis for plant genetic improvement and green production in agriculture.

Keywords: Salt stress; bZIP transcription factors; Molecular regulation; Growing development

INTRODUCTION

Land is an essential resource for human social productive activities and sustainable development. However, population growth and massive greenhouse gas emissions are increasing global temperatures, changing the global climate, further increasing soil salinity, and adversely affecting crop growth and development **(Headey D, 2013)**. Soils with high salinity reduce seed germination rates, stunt plant growth, hinder agricultural development and threaten food security. Soil salinity is one of the major environmental factors affecting agricultural production and food security. To cope with environmental changes, plants have evolved complex signaling pathways **(Abdul-Rahaman A et al., 2018)**. These pathways typically consist of receptors, secondary signals, plant hormones, and signal transducers. Transcription factors are involved in plant resistance processes by binding to various cis elements and regulating the expression of related gene families. A typical transcription factor generally consists of four parts: a DNA-binding domain, a transcriptional regulatory domain, a nuclear localization signal (NLS), and an oligomerization site **(Abdul-Rahaman, A 2021)**. The combined actions of these structural domains determine the temporal, spatial and mode of action of transcription factor regulatory functions. Many transcription factors act as master regulators of gene selection, directing decisions about cell type, developmental patterns, and regulation of specific signaling pathways **(Aker JC et al., 2016)**. Plants generate and transmit various signals to stimulate transcription factors when exposed to biotic and abiotic stresses such as salinity, drought, cold, hot and disease. Transcription factors then bind the appropriate cis-acting elements to activate RNA polymerase and transcribe the complex, thus initiating transcription and expression of specific genes. Eventually the gene product will begin to respond to the signal **(Andersson CI et al., 2015)**. Functional studies of these genes are also important in plant stress tolerance bioengineering, as the fundamental role of transcription factors is to enhance plant stress tolerance. Basic leucine zipper (bZIP) transcription factors, the most common and conserved proteins associated with eukaryotic transcription factors, have important regulatory functions in many biotic and abiotic stressors. The sequence of the basic region is relatively conserved and consists of approximately 20 amino acid residues. The anchored nuclear localization structure N-(X) 7-R/K can specifically bind to DNA cis-elements. The leucine zipper regions is not conserved, consists of one or more repeat regions, and contains numerous hydrophobic residues through oligomerization **(Asfaw S, 2012)**. Transcription factors can be divided into several categories according to the properties of their DNA binding regions. As one of the most widespread and functional transcription factor groups, bZIP transcription factors play important regulatory roles in plant stress responses. During growth and development, plants inevitably experience various stresses such as salinity, drought, waterlogging, and cold weather. The bZIP transcription factor in plants plays a very important role in resisting these hostile natural environments. BZIP has been found to confer salt tolerance to plants such as Arabidopsis thaliana, Lycopersicon esculentum mill, and sunflower and Oryza sativa **(Alexiadis S, 2012)**

According to statistics from China's Ministry of Agriculture, less than 10% of the world's land is suitable for cultivation, and most of the land is in unfavorable conditions. B. Salt water or alkaline land. With environmental degradation and population growth, there is a need to grow economical crops that can grow under a variety of stresses. Transcription factors may improve overall plant resistance. In this paper, we briefly describe the structural and functional properties of the bZIP transcription factor and focus on its role in plant salt stress tolerance and molecular mechanisms **(Bosker M, 2009)**.

Effects of salt stress on plants

Soil salinity is an increasingly serious problem worldwide, severely affecting crop growth and yield, and posing a major challenge to plant breeding.

When plants grow in salty soil, the first problem is that the natural water balance is disrupted. Damage to plants caused by salt damage is called salt damage, and there are primary salt damage and secondary salt damage. Primary salinity refers to the direct action of salt ions that cause significant damage to cell membranes. Secondary salt damage is understood to mean the indirect effects of salt ions. This manifests itself as osmotic stress, making it difficult for plant roots to absorb water, leading to water and nutrient deficiencies. As the salinity in the soil increases, so does the concentration of the soil solution, increasing the osmotic pressure and weakening the uptake of water by plants. When the salt concentration in the soil is too high and the osmotic pressure of the soil solution is higher than the osmotic pressure of the plant cells, the plants can no longer absorb water from the soil, causing the plant roots to dry out and causing physiological drought and plant growth even death **(Chandra AK et al., 2020)**.

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On the one hand, salt stress directly affects the lipid bilayer assembly and membrane protein structure of the cell membrane, thereby increasing the permeability of the lipid membrane and causing membrane lipid peroxidation, thereby affecting the normal physiological function of the membrane. When plants are exposed to salt stress, cells continue to lose water, resulting in changes in cellular turgor and osmotic pressure. Disruption of plant cells and the plasma membrane reduces or even eliminates the selective permeability of the cell membrane, allowing many beneficial ions such as Ca2+ and K2+ to enter the cell. Harmful ions such as Na+ and Cl- accumulate inside the cell, disrupting the ion balance inside the cell. This also leads to damage to cell membranes, organelle membranes and organelle structures. Decreases function, chlorophyll levels and photosynthetic rate. This makes the plant less tolerant of stress damage.

DISCUSSION

Soil salinity is the most important abiotic stress in crop production worldwide, severely limiting seed germination, plant growth and crop production, and threatening food security. About one-third of the earth's land surface is salt water. The problem of soil salinity is particularly acute in China and is one of the main obstacles limiting the improvement of agricultural productivity. At present, China's salt-alkali land area is more than 37.5 million, and it is increasing every year. In crops, soil is the substrate for seed germination and a major factor influencing plant development, growth and final yield. The physiological and metabolic properties of crops are strongly influenced by the environment, but there are relatively few reports on this aspect. Therefore, mechanisms of plant salt tolerance and cultivation of salt-tolerant crop cultivars are current research priorities.

The function of the bZIP transcription factor, especially in plant growth and development, is of great importance for breeding high-quality, high-yielding and stress-tolerant crop cultivars. A growing number of plant transcription factors and their downstream genes are being predicted and validated using bioinformatics and molecular biology techniques. The mechanisms involved in plant stress responses are more complex, as transcription factors are regulated at the post-transcriptional level, especially by directly binding to conserved cis-regulated promoters. On this basis, plant bZIP transcription factors are promising targets for crop improvement as they can control complex agronomic traits and provide positive regulation to improve yield, quality and stress tolerance.

CONCLUSION

An increasing number of plant bZIP transcription factors have been identified, and their taxonomy and distribution will become clearer as the study of these proteins progresses. Moreover, advances in molecular structure and function studies will improve our knowledge of their involvement in gene regulation and expression. The increasing use of bZIP transcription factors in genetic engineering research opens up further possibilities for effective and stable expression of exogenous genes in transgenic plants. Therefore, studying the mechanism of plant germination under salt stress can help to innately enhance germination and seed germination, thereby increasing the final yield of crops. It is very important to fully research and cultivate transgenic salt-tolerant plant resources, discover beneficial genes, improve plant varieties, increase the income of farmers in the growing area, and maintain the regional balance of grains nationwide. is. Three aspects are important for studying the bZIP transcription factor the bZIP regulatory mode is involved in many biological processes of plant growth and development. B. Plant root morphogenesis and salt tolerance mechanisms. However, since the specific regulatory mechanism is not clear, it is necessary to elucidate the regulatory mechanism of downstream genes mediated by bZIP. Complex redundancy of the bZIP subunits, as studies have shown that a single bZIP transcription factor exhibits functional redundancy in plants involved in abiotic stress responses such as salt stress and other processes. It is important to analyze the mechanism of sex regulation. Interactions between bZIP transcription factors, or complexes formed by interactions with other proteins, regulate stress responses and flowering timing, affecting plant yield and quality. The interacting proteins, binding sites, downstream target genes, and biological processes involved in the bZIP subunit should be studied. Analysis of the molecular regulatory network of the bZIP transcription factor is of great importance to enable genetic improvement of crops and exploitation of its traits for agricultural greenery production.

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